LIFE IN WEIGHTLESSNESS BIOLOGICAL LABORATORIES IN ORBIT

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Translation of: "Zhizn' v Nevesomosti. Biologicheskiye Laboratorii na Orbite," Izvestiya, 1 March 1974

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16. Abstract

An account of the flight and experiments conducted aboard the Kosmos-605 biosatellite. Several experiments were conducted with determination of the effect of weightlessness on various phylogenic categories of plants and animals. The experiments revealed weightlessness did not have a pathological effect on the animals, as compared with control specimens on the Earth, but did exert a deforming effect on fungi.

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BIOLOGICAL LABORATORIES IN ORBIT

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In scientific laboratories, investigation of animals and other biological objects returned to the Earth after a three week flight aboard the artificial Earth satellite Kosmos-605 has been completed. Aboard the satellite were several dozen laboratory rats, steppe tortoises, insects, simple fungi and bacterial spores. This was a complex and entirely automatic biological experiment, as a result of which scientists obtained valuable data on the influence of spaceflight factors, primarily weightlessness, of the structure and functions of the living organism.

...Do you not want an interview with our "doubles" — such was the unusual suggestion given in response to journalists' questions on the course of the experiment by the supervisors of the Institute of Medical-Biological Problems, headed by the scientific flight staff. In one of the laboratories of the Institute, on the Earth, a synchronous control experiment was carefully prepared and conducted for the first time. Within a mockup of the spacecraft, containers with the same number of inhabitants as in orbit were placed.

This terrestrial laboratory was a copy of the one which operated in space. The natural "flight" factor which was not experienced by the animals on the Earth was a state of weightlessness. This made it possible for the scientists to obtain a rare objective comparative material on the role of the force of gravity in the functioning of living systems.

The promise of an "interview with the doubles" proved to be purely symbolic, however. The thick wall sides of the spacecraft concealed its inhabitants, each of which was comfortably ensconced in a separate standard box "with all the conveniences". One could only derive information on the feelings of the subjects

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[1]TASS correspondent.

via the telemetry channels — all the information on the animals and the course of the experiment was relayed to the command and control board.

The leading engineer of the experiment suggests "examining" for selection any of the nine multiroom "apartments". Pressing a button on the control board results in numbers replacing each other on the readout panel; these numbers carry complete information on the behavior of the animal in chamber number 5. Operating by the program alone, the device gave the animal its food and turned off the light in their "apartments". It was time to sleep, but "double number 5" was awake as before. On the control panel one could see that he moved at an activity rate of 10 to 15 arbitrary units per minute...

In the course of the experiment, the problem of obtaining information on the motor activity of animals in flight was solved in an original fashion. The well of each box contained a light spiral circuit along which a weak current ran. The experimental animal in this magnetic system plays the role of a unique core whose every movement influences the character of the current running through the solenoid. Hence, from each object of investigation we obtained operational, reliable information easily processed by computer during the flight.

On 22 November 1973, the satellite Kosmos-605 left its orbit and returned to the Earth. At the site of landing was a mobile biological laboratory and there the first investigation of the inhabitants of Kosmos-605 was carried out by specialists literally on wheels. Then the animals were taken to the same vivarium where they had undergone selection "training" before flight.

What are the first scientific results of the operation of the biological laboratory in orbit?

The primary success, says one of the scientific supervisors of the experiment, consists in the fact that success was attained in obtaining a broad statistically reliable material on the effect of weightlessness on the living organism.

New facts were added to those already known in space medicine and biology to the effect that long term weightlessness noticeably influences the course of metabolic processes. A deterioration in tissue respiration, decrease in body temperature, changes in certain muscles, and suppression of the so-called blood growth in the bone marrow were detected, for example. There was a

noticeable decrease in the resistance of the bones in the animals extremities. Changes in the weight of certain internal organs and endocrine glands — the spleen, gizzard, adrenals, and kidneys were also detected. Moreover, no pathological changes were found in the organism. Three to four weeks after landing, the animals did not differ from their "doubles" with respect to most indices.

A second generation of insects which developed under conditions of weightlessness was obtained for the first time in space biology. These were the drosophila fruit flies. Specialists did not find any differences with respect to the amount and nature of genetic information between the first and second generations. It is curious that in an experiment with bacterial spores no influence of weightlessness on their viability or genetic apparatus were detected either.

For the first time, experimental confirmation was obtained for the fact that the influence of weightlessness on processes of plant morphology. There is a small greenhouse aboard the satellite containing nonphotosynthesizing fungi. In the absence of the terrestrial gravitation, the fungi developed quite strange forms. They differed from their "doubles" raised in the terrestrial experiment by very fine and strangely formed pedicel and also by more massive size.

Finally, one more weightlessness success was linked with the radiation--physical experiment conducted aboard the satellite. The problem of further developing the system of radiation protection for spacecraft crews and protection for spacecraft equipment was solved. As a result of the flight, new data on the effectiveness of electrostatic protection against charged particles were obtained. An apparatus for creating electrical fields around the spacecraft and for deflecting fluxes of charged particles of outer space was tested. New types of instruments of dosimetric controls were also tested.

Todays experiments in the near-Earth orbit are not only a new contribution to the development of space medicine and biology. They have given science new data for a deeper understanding of the principles lieing at the foundation of the vital activity of organisms.

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